Brief Communication

A patient with partial seizures manifested as panic attacks and auditory hallucination

Hirotaka Kosaka^{1,2}, Tetsuhito Murata¹, Tetsuya Takahashi¹, Masao Omori³, Hidehiko Okazawa² and Yuji Wada¹

¹Department of Neuropsychiatry, Faculty of Medical Sciences, University of Fukui, Eiheiji, Fukui, 910-1193, Japan

²Biological Imaging Research Center, University of Fukui, Eiheiji, Fukui, 910-1193, Japan

³Department of Social Welfare Science, Faculty of Nursing and Social Welfare Sciences, Fukui Prefectural University, Eiheiji, Fukui, 910-1195, Japan

Key words: epilepsy, panic attacks, auditory hallucination, carbamazepine, positron emission tomography (PET), Cambridge Neuropsychological Test Automated Battery (CANTAB)

Received Feb 23, 2009; Accepted Oct 15, 2009 ; Published online Oct 23, 2009

Abstract

We report a case of a 51-year-old man presenting anxiety and autonomic symptoms of panic-like attacks and simultaneous auditory hallucination. No abnormalities were evident in a physical examination but his cognitive function was impaired. Thus panic disorder or non-specific dementia with psychosis was initially suspected. Brain MRI was almost normal, except for an old right basal ganglia infarction and mild frontal atrophy. Neuroimaging studies showed reduced glucose metabo-

lism over bilateral frontal, right temporal and right parietal regions. When a panic-like attack occurred, EEG documented ictal discharges in the right frontal and temporal areas. After successful treatment with carbamazepine, cognitive dysfunction and abnormal findings on brain imaging were improved. This case suggests that epilepsy should be suspected in a patients presenting with anxiety symptoms of panic-like attacks and hallucinations.

Corresponding author: Department of Neuropsychiatry, University of Fukui, Eiheiji, Fukui, 910-1193, Japan.
TEL: +81-776-61-8363 Fax: +81-776-61-8136 Email: hirotaka@u-fukui.ac.jp (H.Kosaka)

1. Introduction

Epileptic disorders may manifest various psychiatric symptoms such as depressed mood, anxiety, fear, psychosis, personality change, decline of cognitive function, and delirium [1]. The prevalence of psychotic disorders including hallucinations and delusions caused by epilepsy is approximately 7% [2]. When compared to that among the general population, the prevalence of anxiety disorders including panic disorder is significantly higher (25%) in patients with epilepsy [3]. Distinguishing the symptoms of seizure disorder from those of psychiatric illness is known to be difficult because of occasional similarity in the presentation of these conditions [4, 5].

We report a case of a male patient who presented only with panic attacks, which was first misdiagnosed as panic disorder. The patient also experienced verbal auditory hallucinations simultaneous to the panic attacks. He was later diagnosed with simple partial seizures because ictal EEG documented repetitive epileptiform discharges in the right frontal and temporal areas. In this rare case, we measured glucose metabolism and assessed cognitive function before and after treatment with antiepileptic drugs.

2. Case Report

The patient was a 51-year-old man who experienced sudden panic attacks. The episode started with trembling and chills, causing chest pain and discomfort, and the patient had a sensation of breathlessness, feeling of choking, palpitations, sweating, nausea, faintness,

and fear of losing control or dying. A series of these symptoms of panic attacks lasted within one minute. The patient was admitted to an emergency hospital. He had no history of neurological or psychiatric disease, and there was no sign of drug or alcohol abuse. His symptoms suggested panic disorder because ECG and brain CT showed no apparent abnormal findings. He was treated with a selective serotonin reuptake inhibitor (SSRI) and anti-anxiety drugs without benefit, and his condition worsened. The panic episodes began to occur almost daily and auditory hallucination of a *sumo* wrestler's shouts into his left ear developed simultaneously with the panic attack. The auditory hallucinations consisted of a few shouts and occurred only during periods of panic attacks. After a few seconds of the onset of panic symptoms, auditory hallucination started and lasted for a few seconds during the panic symptoms. The episodes continued for seven months and his anticipatory anxiety worsened. Then he was admitted to our hospital for detailed examinations.

On admission, the main symptoms were anxiety and autonomic symptoms of panic attacks and simultaneous verbal auditory hallucinations. The patient showed fluctuation of cognitive functions including verbal fluency, and his Mini Mental State Examination (MMSE) scores ranged from 21 to the maximum. A physical examination revealed no abnormalities. Therefore, panic disorder or mild cognitive impairment was suspected. Brain MRI was normal except for an old right basal ganglia infarction and mild frontal atrophy. N-isopropyl-p-¹²³I-iodoamphetamine sin-

gle photon emission computed tomography (^{123}I -IMP-SPECT) revealed decreased blood flow in bilateral broad frontal lobes, right posterior temporal and parietal regions, and right basal ganglia. ^{18}F -fluorodeoxyglucose positron emission tomography (^{18}F -FDG-PET) demonstrated decreased glucose metabolism in bilateral broad frontal lobes, right posterior temporal and parietal lobes, bilateral posterior cingulate gyri, and right basal ganglia (Figure 1).

On the first day of hospitalization, routine electroencephalographic (EEG) examination showed a slow alpha basic rhythm (8 Hz dominant) with no other abnormal findings. After a few days of hospitalization, we were able to record ictal EEG (Figure 2), which showed repetitive epileptiform discharges in the right frontal and temporal areas during a panic attack with auditory hallucinations. During the attack, the patient had an agonized expression with trembling, cold sweat, and a feeling of numbness. On EEG, the basic alpha rhythm wave then disappeared, and generalized desynchronization appeared, followed by low-amplitude fast wave activity. At 20 s after generalized desynchronization, spike-and-wave patterns appeared and continued in right frontal and temporal areas (F4 and T4). Panic attacks also increased his heart rate from 70/min to around 140/min. Steady slow alpha rhythm of approximately 8 Hz returned after one minute. Later, he was asked about his feelings at the time of the attack. He described chest discomfort, palpitations, fear, and auditory hallucinations in his left ear.

Simple partial seizure was diagnosed and

carbamazepine treatment was started at 200 mg daily from one week after hospitalization. This treatment led to a gradual reduction in the number of panic attacks with auditory hallucination at two weeks. The attacks ceased within a week after an increase of dosage to 300 mg/day (5.3 $\mu\text{g}/\text{ml}$). After treatment with carbamazepine, several EEG examinations no longer showed epileptiform discharges and the basic rhythm was elevated from 8 Hz to 9 Hz. A ^{18}F -FDG-PET scan showed recovery of glucose metabolism in the left frontal lobe, right posterior temporal region, and bilateral posterior cingulate gyri (Figure 1).

After drug treatment, the MMSE scores reached the maximum. To examine frontal functions in detail, we conducted the Cambridge Neuropsychological Test Automated Battery (CANTAB, <http://www.camcog.com/camcog/default.asp>) before and after treatment. Before treatment, the patient showed lower scores for Pattern Recognition Memory (PRM, standard score = -0.86), Spatial Recognition Memory (SRM, standard score = -0.72), Intra/Extradimensional (IED, standard score = -0.41) and Reaction Time (RTI, standard score = -1.03), indicating frontal lobe dysfunction including impairment of recognition memory, working memory, and attentional shift. In contrast, temporo-hippocampal function was not impaired, based on the scores for visuospatial Paired Associates Learning (PAL, standard score = 0.72) and Delayed Matching to Sample (DMS, standard score = 1.19). After carbamazepine treatment, the scores of the frontal lobe function tests improved (PRM, standard score = 0.02 ; SRM,

standard score = 0.84; IED, standard score = 0.06; RTI, standard score = 0.20).

Fig. 1: Three-dimensional stereotactic surface projection (3D-SSP) images of ^{18}F -FDG-PET performed before (a) and after (b) treatment. (a) Before treatment, decreased glucose metabolism was detected in bilateral broad frontal lobes, right posterior temporal and parietal regions, and bilateral posterior cingulate gyri. (b) After treatment, decreased glucose metabolism was resolved in the left frontal lobe, right posterior temporal region, and bilateral posterior cingulate gyri.

Fig. 2: Ictal EEG findings. At first, the patient had trembling, cold sweat, and a feeling of numbness. Then, the basic EEG rhythm (alpha activity) disappeared, and generalized desynchronization appeared, followed by low-amplitude fast wave activity. At 20 s after generalized desynchronization, repetitive epileptiform discharges were recorded in the right frontal and temporal areas (F4 and T4). Then his symptoms developed into a sensation of breathlessness, feeling of choking, palpitations, sweating, nausea, faintness, and fear of losing control or dying. Heart rate was increased from 70/min at baseline to 140/min. Calibration, 50 μV , 1 sec.

3. Discussion

To our knowledge, this is the first report of a patient with epilepsy manifesting panic attacks and auditory hallucinations simultaneously, in whom detailed measurements of brain metabolism and cognitive function were made before and after drug treatment. The patient manifested various clinical symptoms simultaneously during seizures, including anxiety and autonomic symptoms of panic attacks and verbal auditory hallucination.

Panic attacks are a common feature of panic disorder. The psychiatric diagnosis is characterized by the presence of recurrent, unexpected panic attacks followed by at least one month of persistent concern about having another attack [6]. Epilepsy can be accompanied by changes in cognition, personality, affect and other elements of behavior. Although panic attacks are not a common manifestation in most patients with epilepsy, a subgroup of these patients manifest panic attack symptoms during partial seizures. The most common affective symptoms in these patients are fear and anxiety, which are almost indistinguishable from symptoms of panic disorder. There is a high degree of overlap between symptoms of panic disorder and panic attacks in epilepsy. Therefore, the correct diagnosis can easily be missed [5, 7]. However, a few studies have suggested that compared with panic disorder, the typical features of partial seizures with ictal fear are a short duration of attacks (usually 1–2 min), the possibility of hallucinations, no agoraphobia, lack of response to conventional treatment for panic attacks, age older than 45 years at the onset of attacks, and

abnormal EEG [7, 8]. These characteristics are consistent with those found in our case. Finally epilepsy was diagnosed based on the short duration of panic attacks and ictal EEG findings.

Controlled studies of clinical therapy for anxiety disorders in patients with epilepsy have not been performed [8]. The epileptic symptoms in our patient showed no response to an SSRI, but completely disappeared after using carbamazepine. Although antiepileptic drugs are helpful for partial seizures, antidepressants occasionally worsen seizures [9–10], and these drug effects were also observed in our patient. Along with improvement of clinical seizures in our patient, decreased glucose metabolism in the frontal and temporal areas were also resolved. In addition, CANTAB findings indicated improvement of frontal lobe dysfunction.

Ictal anxiety including panic attacks and fear is most often experienced by patients with simple partial seizures of temporal lobe origin including the amygdala [11]. However, ictal anxiety has also been reported in cases of extratemporal epilepsy [8]. In an invasive electrode study, ictal fear was associated with seizure spread involving the orbitofrontal, anterior cingulate, and temporolimbic cortices, irrespective of whether the seizure arose in the temporal or frontal region [12]. Consistent with these findings, PET findings in the present study also suggest that fronto-temporal abnormality was involved in the expression of ictal symptoms in our patient.

In an invasive electrode study, hallucination was found to occur more often in the right

than in the left temporal lobe and the focus of language auditory hallucination was associated with the lateral temporal area [13]. In our patient, the language auditory hallucination from his left ear might be associated with seizure spread involving the right temporal gyrus, as observed in abnormal EEG findings.

The results reported herein suggest that epilepsy should be suspected in patients with panic disorder. In particular, EEG monitoring should be performed in patients who manifest panic attacks of short duration, had psychotic symptoms such as hallucinations, and respond poorly to SSRI.

Acknowledgements

This study was supported by the 21st Century COE program (Medical Science) and a Grant-in-Aid for Young Scientists 18790826 from the Japan Society for the Promotion of Science (JSPS).

References

- [1] Devinsky O, Vazquez B. Behavioral changes associated with epilepsy. *Neurol. Clin.* 1993; 11: 127-149.
- [2] Matsuura M, Oana Y, Kato M, Kawana A, Kan R, Kubota H, Nakano T, Hara T, Horioka N. A multicenter study on the prevalence of psychiatric disorders among new referrals for epilepsy in Japan. *Epilepsia.* 2003; 44: 107-114.
- [3] Swinkels WA, Kuyk J, de Graaf EH, van Dyck R, Spinhoven P. Prevalence of psychopathology in Dutch epilepsy inpatients: a comparative study. *Epilepsy Behav.* 2001; 2: 441-447.
- [4] Daly KA, Kushner MG, Clayton PJ, Crow S, Knopman D. Seizure disorder is in the differential diagnosis of panic disorder. *Psychosomatics* 2000; 41: 436-438.
- [5] Sazgar M, Carlen PL, Wennberg R. Panic attack semiology in right temporal lobe epilepsy. *Epileptic Disord.* 2003; 5: 93-100.
- [6] American Psychiatric Association. Diagnostic and statistical manual of mental disorders 4th ed. Washington, DC: American Psychiatric Association. 1994.
- [7] Thompson SA, Duncan JS, Smith SJ. Partial seizures presenting as panic attacks. *BMJ* 2000; 321: 1002-1003.
- [8] Beyenburg S, Mitchell AJ, Schmidt D, Elger CE, Reuber M. Anxiety in patients with epilepsy: systematic review and suggestions for clinical management. *Epilepsy Behav.* 2005; 7: 161-171.
- [9] Vazquez B, Devinsky O. Epilepsy and anxiety. *Epilepsy Behav.* 2003; 4: S20-S25.
- [10] Thomé-Souza MS, Kuczyński E, Valente KD. Sertraline and fluoxetine: safe treatments for children and adolescents with epilepsy and depression. *Epilepsy Behav.* 2007; 10: 417-425.
- [11] Mintzer S, Lopez F. Comorbidity of ictal fear and panic disorder. *Epilepsy Behav.* 2002; 3: 330-337.
- [12] Biraben A, Taussig D, Thomas P, Even C, Vignal JP, Scarabin JM, Chauvel P. Fear as the main feature of epileptic seizures. *J. Neurol. Neurosurg. Psychiatry* 2001; 70: 186-191.
- [13] Penfield W, Perot P. The brain's record of auditory and visual experiences: a final summary and discussion. *Brain* 1963; 86: 595-696.